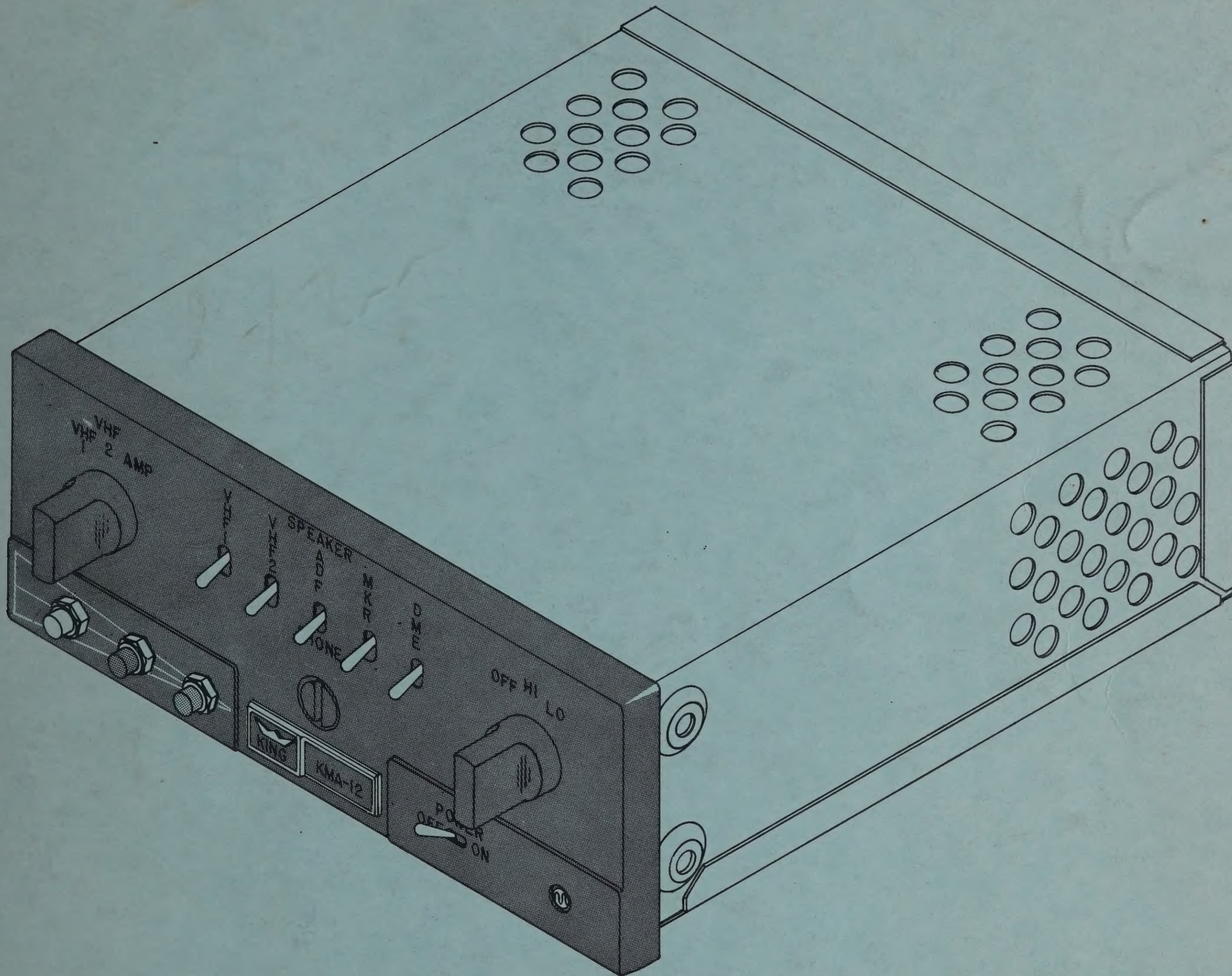
Builders of TOMORROW'S Aircraft Equipment TODAY!



KING

Instruction Manual

KMA-12

MARKER BEACON / ISOLATION AMPLIFIER

ONE FULL YEAR WARRANTY

King Radio Corporation, Inc., Olathe, Kansas, has designed, engineered and constructed this equipment with the finest material and components available. This equipment has been thoroughly tested and inspected before leaving the factory.

King Radio Corporation, Inc., (hereinafter called King), warrants each item of new equipment manufactured by it to be free from defects in material under normal use for which intended for one year from the effective date of the warranty certificate.

King will hereunder replace or repair (at King's discretion) at any of King's certified Dealers, any King part or component (including vacuum tubes and transistors), which shall within such warranty period, be returned, transportation charges prepaid to any King certified Dealer. Any King certified Dealer may perform work under the terms of this warranty. Such Dealer, if authorized in advance by King, may return the part or unit to King's factory for compliance with this warranty. This warranty of parts includes, for the first ninety (90) days thereof, bench time required to locate the defect, repair same or replace such part.

THIS WARRANTY SHALL NOT APPLY TO ANY UNIT OR PART THEREOF, WHICH, IN THE JUDGMENT OF KING, HAS NOT BEEN INSTALLED IN ACCORDANCE WITH THE INSTALLATION INSTRUCTIONS PROVIDED IN THE MAINTENANCE MANUAL, OR HAS BEEN REPAIRED OR ALTERED IN ANY WAY SO AS ADVERSELY TO AFFECT ITS PERFORMANCE OR RELIABILITY, OR WHICH HAS BEEN SUBJECTED TO MISUSE, NEGLIGENCE OR ACCIDENT.

This warranty is in lieu of all other guaranties or warranties expressed or implied. The obligation and responsibility of King for, or with respect to, defective equipment shall be limited to that expressly provided herein and King shall not be liable for consequential or other damage or expense whatsoever therefor or by reason thereof.

King reserves the right to make changes in design or additions to or improvements in its equipment without obligation to install such additions or improvements in equipment theretofore manufactured.

KMA-12

MARKER BEACON/ISOLATION AMPLIFIER

PERFORMANCE SPECIFICATIONS

MARKER BEACON

		"HI"	"LO"
SENSITIVITY:	1300cps	250u volts	1500u volts

AGC: Less than 6db rise in audio output with input of 500 microvolts to 500,000 microvolts in "HI" sensitivity position.

SPRUIOUS: At least 50db down.

AUDIO OUTPUT: From isolation amplifier with an RF input of 5000uv modulated 95% with 1300 cps.
4Ω output 0.50 watts minimum.

ISOLATION AMPLIFIER

INPUTS: Five isolated audio inputs.

AUDIO OUTPUT:
13.75V
6.0 watts undistorted into 4Ω.
6.0 watts undistorted into 8Ω.

27.5V
8.0 watts undistorted into 4Ω.
8.0 watts undistorted into 8Ω.

FREQ. RESPONSE: Within 3db from 250 cps to 5000 cps.

AUDIO MUTING: Audio is muted when transmitter is keyed.

ISOLATION: More than 20db between input channels.

CURRENT DRAIN: 13.75V 1.1Amp
27.5V 1.1Amp

SIZE: 2.50" high x 6.50" wide x 7.19" depth. 6.35cm x 16.51cm x 18.2 cm depth.

WEIGHT: 2 pounds 11 ounces.

GENERAL INFORMATION

The King KMA-12 is a compact transistorized unit providing the functions of marker beacon receiver, isolation speaker amplifier, audio control panel, and electronic muting.

The KMA-12 has been designed to work with other components of the King Radio Silver Crown units to provide a uniformly functioning aircraft system. The KMA-12 switching circuits are designed to accommodate two VHF 1 1/2 systems such as the KX-160 or KX-150B, a distance measuring equipment such as the KN-60 or KDM-700 and an automatic direction finder, KR-80.

The marker beacon receiver in the KMA-12 has been engineered and manufactured to satisfy the requirements of the professional pilot. A three light presentation is designed into the front panel with appropriately colored lights to indicate the passage over Z markers, outer marker, and middle marker. A light sensor and control circuit is incorporated in the receiver to control the brightness of the indicator lights to a level appropriate for the ambient light in the cockpit. A rotory switch is provided to activate the marker receiver and to select high or low receiving sensitivity. A toggle-switch is provided along with (4) other audio switches to connect the cockpit speaker or to the pilot's headphone. The marker beacon receiver utilizes 17 transistors and 4 diodes to accomplish it's functions. The receiver is a crystal controlled superheterodyne type and has excellent selectivity and freedom from interference of television and F M stations.

The isolation type speaker amplifier incorporated in the KMA-12 is designed for low distortion and flat frequency response. Output capacity is sufficient for a cockpit speaker or an external speaker mounted in the aircraft nose or wheel well and utilized as a "ramp hailer". The amplifier and associated regulated power supply utilizes 5 silicon type transistors for inherent reliability. The isolation type amplifier, as used in the KMA-12, makes possible the combining of all receivers into a single speaker without loss of speech quality or volume.

A series of five, three position toggle type, switches on the KMA-12 front panel may be used to switch and audio output from the two VHF Nav/Comm units, the ADF, the DME, and the marker beacon, individually or collectively, either to the cockpit speaker through the isolation amplifier or directly to the headphone jack or to the pilot and co-pilot headphone jack.

A rotory switch is provided on the front panel of the KMA-12 to change the microphone connection and the microphone control circuits to either number one or number two VHF equipments of to a third position which then properly routes the microphone output to the external ramp speaker, or if desired, to a cabin speaker in aircraft utilizing a separated cockpit and cabin area.

An electronic muting circuit is provided to automatically isolate the output of all receivers from the isolation amplifier whenever the microphone button is pressed. This feature eliminates the possibility of audio feedback in the cockpit.

A series type solid state regulator is used to supply the power for the low level audio stages of the isolation amplifier and all circuits of the marker beacon receiver. Consequently, the only wiring changes necessary when switching from 14 to 28 volts is that of the instrument lights. (See Fig. 4 & 5). The regulator also eliminates all alternator noise and generator ripple from appearing in the audio outputs when used with other equipments of the King Silver Crown line.

INSTALLATION

The KMA-12 Marker Beacon Amplifier is designed to be mounted in the aircraft instrument panel and may be mounted in any location which will accommodate the necessary front panel and depth. See Fig. 1 for dimensional information. Since all of the transistors used in the KMA-12 are the silicon type, the unit is capable of operating in a high ambient temperatures. The KMA-12 is shorter than most other panel mounted radio components and it is suggested that it be mounted in the top of the vertical stack in those aircraft having such a mounting arrangement. Since it would be difficult to reach the rear connector of such a short unit mounted in the top of a radio stack, the rear connector is attached to the equipment cover and the KMA-12 is held in the equipment cover by a front operated locking device. On all receivers which have a separate audio ground connection in their connector it is suggested that all of these grounds be carried to the KMA-12 grounding pins. This will eliminate the possibility of ground current noises being introduced into the audio system. It is also suggested that the grounding connection from the speaker or speakers be made at the KMA-12 ground terminals.

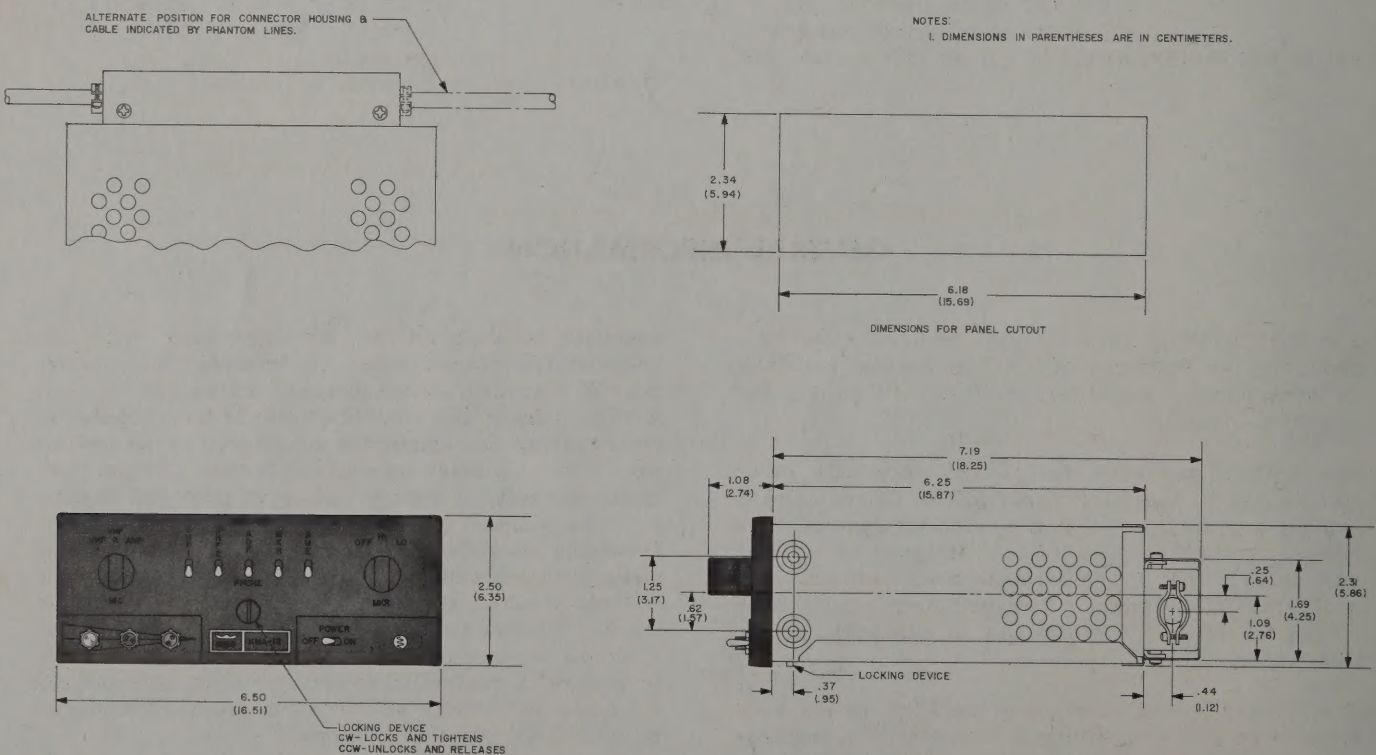


FIG-1 KMA-12 INSTALLATION DRAWING

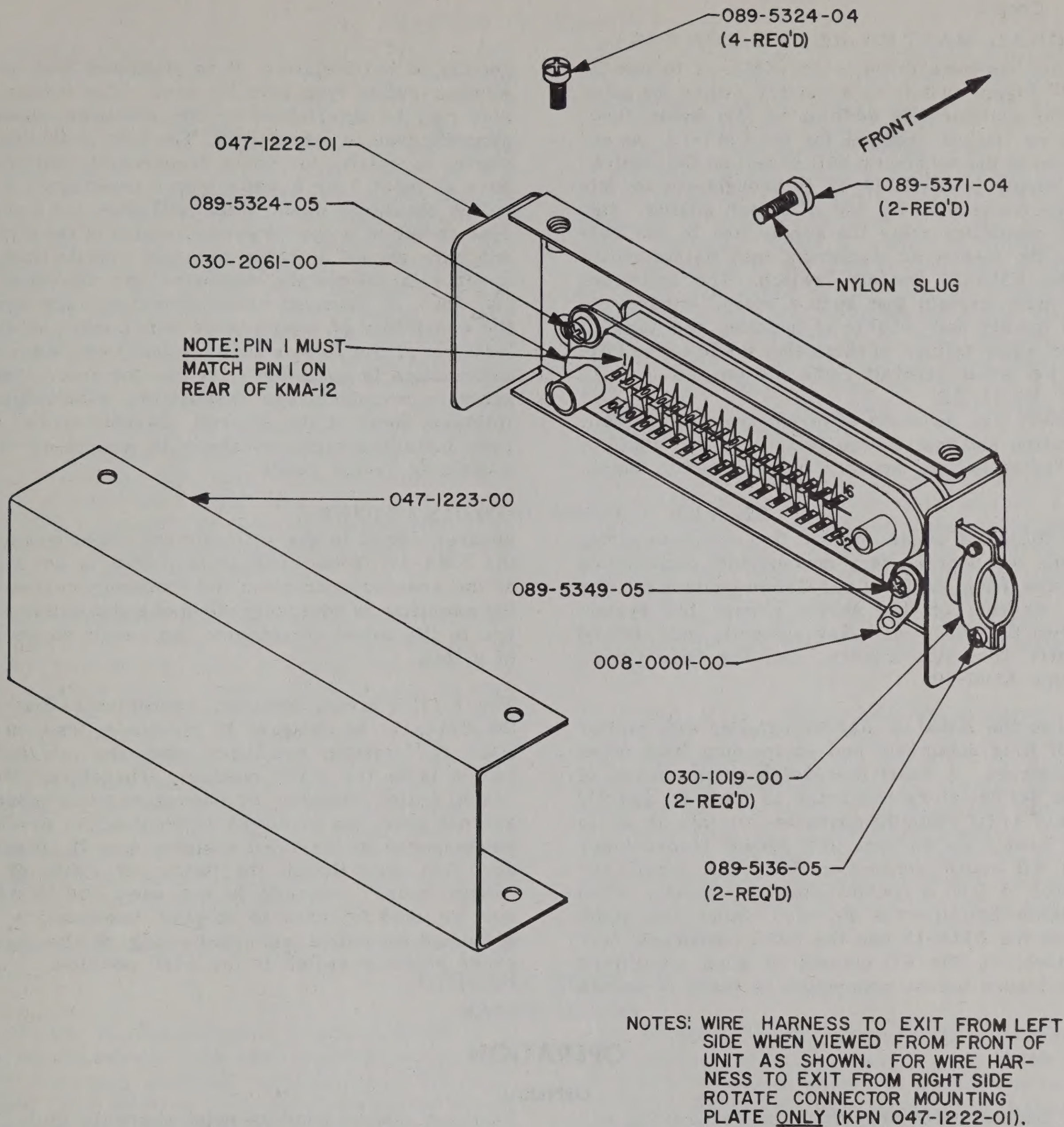


FIG. 2 CONNECTOR ASSEMBLY MOUNTING

When shipped, the protective cover and clamp on the rear of the KMA-12 is assembled for the cable to emerge from the left side of the unit. However, should the location in the panel indicate a more direct cable, the cover and clamp may be reversed so that the cable exits from the right side of the KMA-12. See Fig. 2. Care should be taken to make certain that none of the wires on the connector are caught when tightening the cable clamp.

MARKER ANTENNA INSTALLATION

Any standard type Marker Beacon Receiver antenna may be used with the KMA-12. However, due to the possible variation and sensitivity of the antenna, it is suggested that a flight check be made after installation to determine if the sensitivity setting in the receiver should be changed to compensate for the sensitivity of the antenna. It is recommended that co-axial cable RG-58/U be used for connecting the antenna to the KMA-12 receiver. Standard type aircraft hookup wire may be used for the balance of the installation.

OPTIONAL MASTER RELAY CONTROL

Provision has been made in the KMA-12 to use the "on/off" toggle-switch as a master switch for all of the radio equipment in addition to it's basic function as an "on/off" control for the KMA-12. An examination of the schematic will show that the switched A+ supply in the KMA-12 is brought out to (pin 4) of the connector. By use of a high quality, high current capability relay the supply line to the balance of the electronic equipment may be controlled from the KMA-12 "on/off" switch. The installers should make certain that such a relay, if used, is of high quality and capable of handling the current involved since failure of this relay would cause failure of the whole aircraft radio system.

RAMP HAILER

Since there are so many different types of aircraft, the location and installation procedure for the optional "ramp hailer" speaker must be left to the ingenuity of the installer. It is suggested that an all weather reflex type horn be used. The choice and size may be determined by the available space in aircraft nose or wheel well. The horn should be designed especially for voice frequencies and should have at least 7 or 8 watts power capability. A location should be made which will allow the most direct radiation in the forward direction of the aircraft and care should be taken to make certain that the speaker is adequately supported for vibration and "G" load. A thorough check should be made against the possibility of interference with moving struts or linkages of the flap or gear mechanisms. When such information is available it is recommended that the aircraft manufacturers installation information be followed. Some of the aircraft manufacturers have been installing ramp speakers in several of their models in recent years.

SILVER CROWN COMBINATIONS

On the following pages you will find complete wiring diagrams for nearly every conceivable combination of the new King Radio Silver Crown equipment. One wiring diagram of this series covers the system using two KX-160 Comm/Nav systems, one KR-80 Automatic Direction Finder, and the Gold Crown DME type KDM-700.

Of course the KMA-12 may be installed with earlier types of King equipment and equipments from other manufacturers. A short discussion on the usage of the two 4Ω resistors connected to (pins 20 and 21) and the 7 1/2Ω resistor connected to (pin 7) is in order. Nearly all current and recent transceivers have a 4Ω output connection from the amplifier-modulator to feed a cockpit speaker directly when an isolation amplifier is not used. Since the audio inputs to the KMA-12 use the 500Ω headphone output connection, the 4Ω outputs of such amplifiers are not loaded unless connection is made from the speaker output to the 4Ω resistors incorporated in the KMA-12. When such an amplifier is not loaded at the speaker connection the frequency response of the amplifier is adversely affected and possible damage to the output transistors can result do to lack of a load.

The 7 1/2Ω 5 watt resistor, connected to (pin 7) of the KMA-12, is designed to provide a load on the KMA-12 isolation amplifier when the microphone switch is in the AMP position. Therefore, if the "ramp hailer" speaker or passenger cabin speakers are not used, the 8Ω output connection (pin 6) should be jumpered to the 7.5Ω resistor (pin 7). It can be seen that even though the passenger cabin or the "ramp hailer" speaker is not used, the KMA-12 may be used for pilot to co-pilot intercom by use of headphone output and positioning of the microphone selector switch in the AMP position.

OPERATION

GENERAL

Marker beacon receivers are used to provide accurate fixes by informing the pilot of his passage over beacon stations located on airways and ILS approach courses. Three types of beacons are used. There are the "Z" or fan marker, the outer marker and the middle marker.

The "Z" or fan marker is located at the sites of low frequency range stations. The beacon transmitter and antenna is designed to project a cone shaped pattern of 75 megacycle energy, vertically. The radio frequency output of the transmitter is modulated with an audio tone of 3000 cps. An aircraft equipped with the KMA-12 will receive 3000 cps tone in headphone or speaker and the white lamp will be lighted while over the station. The fan markers are used to identify the low frequency range course on which it may be located or to mark a definite point along an airway.

The outer and middle markers are used in conjunction with the radio instrument landing systems. The outer marker is normally positioned on the front localizer course near the point where the glide slope approach path intersects the minimum inbound altitude after the procedure turn. Distance from the airport will vary from 4 to 7 miles. Radio frequency from the marker is projected vertically in an elliptical cone shaped pattern. The marker signal is modulated at 400 cps and is keyed to emit dashes at a rate of two per second. When passing the outer marker the blue light will flash "on/off" at a two per second rate and the pilot will hear a series of low tone dashes.

The middle marker is normally located on the front localizer course about 3200 feet from the approach end of the ILS runway. The radiated pattern is similar in shape and power to the outer marker. The middle marker signal is modulated with 1300 cps and the modulation is keyed to identify by alternate dots and dashes. When the KMA-12 equipped aircraft passes the middle marker the pilot hears a medium pitched tone in a series of dots and dashes and the amber light flashes synchronously with the tones.

The marker beacon function in the KMA-12 provides the pilot with both sensitivity and audio switching controls. Many marker receivers provide only a "low sensitivity" position. The effect of the high sensitivity position is to greatly enlarge the size of the cone shaped "area of indication" above the station. An aircraft flying at high altitude or slightly off course may fail to receive the signal when in the low sensitivity position. It is suggested that the KMA-12 marker first be placed in high sensitivity position until aural and/or lamp indication is received. The control switch may be turned to low sensitivity to reduce the duration of the indication and to obtain a more accurate reading of passage since the signal appears to build and fade faster on low sensitivity. When switching out of "high" sensitivity the pilot may choose to rotate the control switch to "low" position and obtain the exact time of center passage from the light only, since the imminence of station passage has already been called to his attention. This suggestion is especially appropriate if he is involved in radio communication with approach control or tower at that moment.

The high sensitivity position may be used to effectively give the pilot an "outer-outer" marker fix. In order to expedite the ILS approach the pilot may wish to retain higher speed until he is near the outer marker inbound. With the KMA-12 marker in high sensitivity position the aural tone will begin about one mile from the outer marker. At this time, the pilot may switch the KMA-12 marker to low sensitivity and reduce engine power for final approach speed, also retrim and perform cockpit checks. He is thus prepared to begin descent when the KMA-12 marker indicates actual passage over the outer marker and the glide slope is intersected.

The microphone control on the front panel of the KMA-12 allows the pilot to transmit from either of two VHF transmitters. The AMP position on the microphone selector switch provides the pilot with several capabilities depending on the option made at installation. This position connects the microphone to the input of the isolation amplifier and the output of the amplifier is normally connected to a speaker mounted in the aircraft nose or in the wheel well under the wing. Thus a means of communication with personnel on the airport ramp is provided. Alternately, the output of the KMA-12 amplifier may be connected to cabin speakers for a pilot announcements in those aircraft which have separate cockpit and cabin areas. If neither of these functions are desired, the amplifier may be used for intercommunication between pilot and co-pilot using the microphones and headphones.

Each of the five toggle type switches in the center of the KMA-12 panel may be switched from a center muting position to connect each receiver to the cockpit speaker in the "up" position, or to the headphone circuit in the "down" position. Since individual control is provided, the pilot may listen to VHF one receiver, on the cabin speaker while the co-pilot could moniter the VHF two receiver, using headphones.

In larger aircraft having separate passenger compartments, where the amplifier is connected into the cabin speaker system, one of the receivers may play into the passenger area by placing the desired toggle-switch in speaker position and turning the microphone control to amplifier position. The pilot and co-pilot may then moniter other receivers by other headphones, and announcements may be made in the passenger area by simply pressing the microphone button.

CIRCUIT THEORY

MARKER BEACON

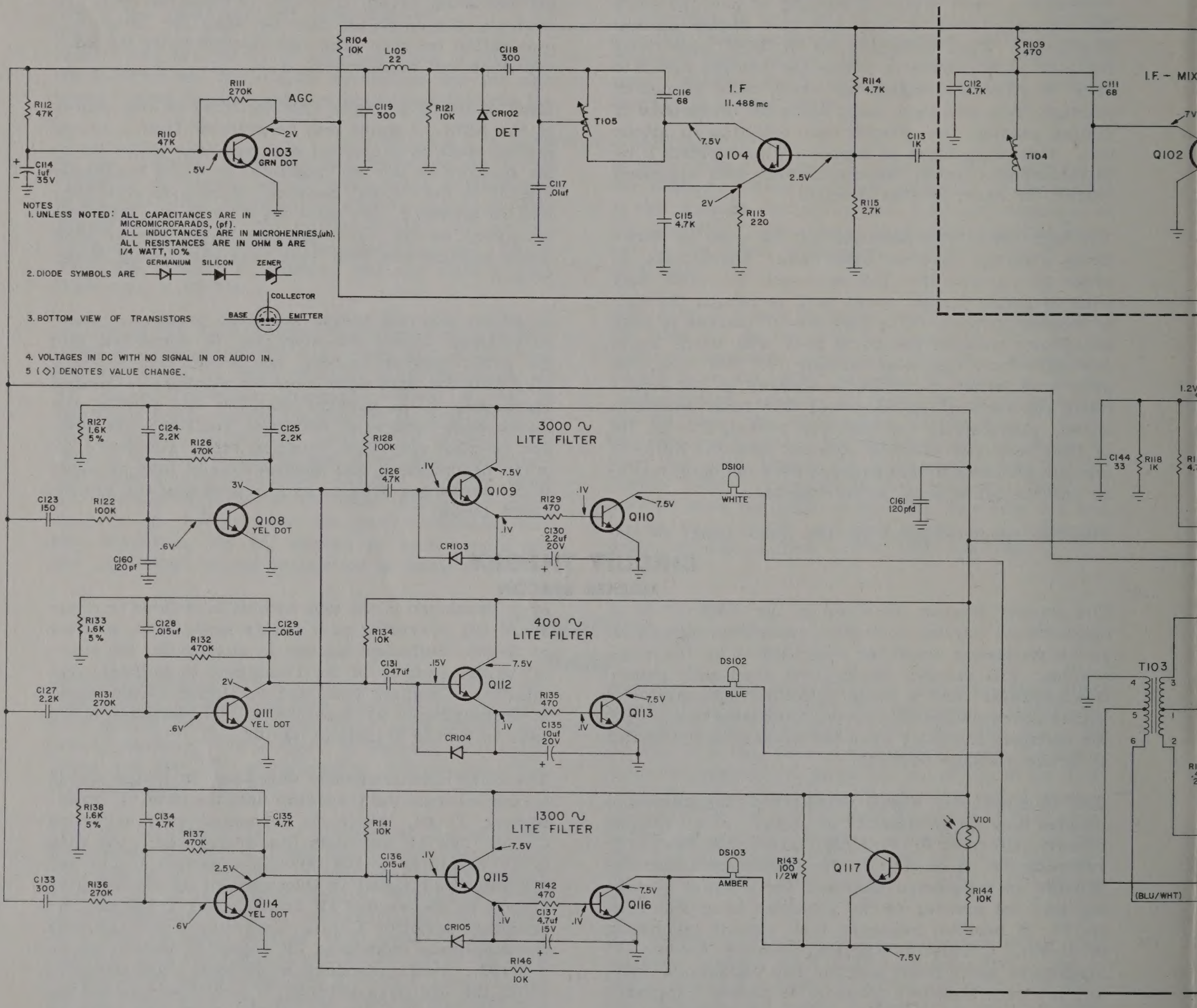
The Marker Beacon Receiver in the KMA-12 is a conventional crystal controlled superheterodyne with an IF frequency amplifier operating at 11.488 megacycles. The detector feeds three frequency selective amplifiers and a audio amplifier with sufficient gain to operate directly into the headphone line or into the isolation amplifier when the audio selector switch is in the speaker position.

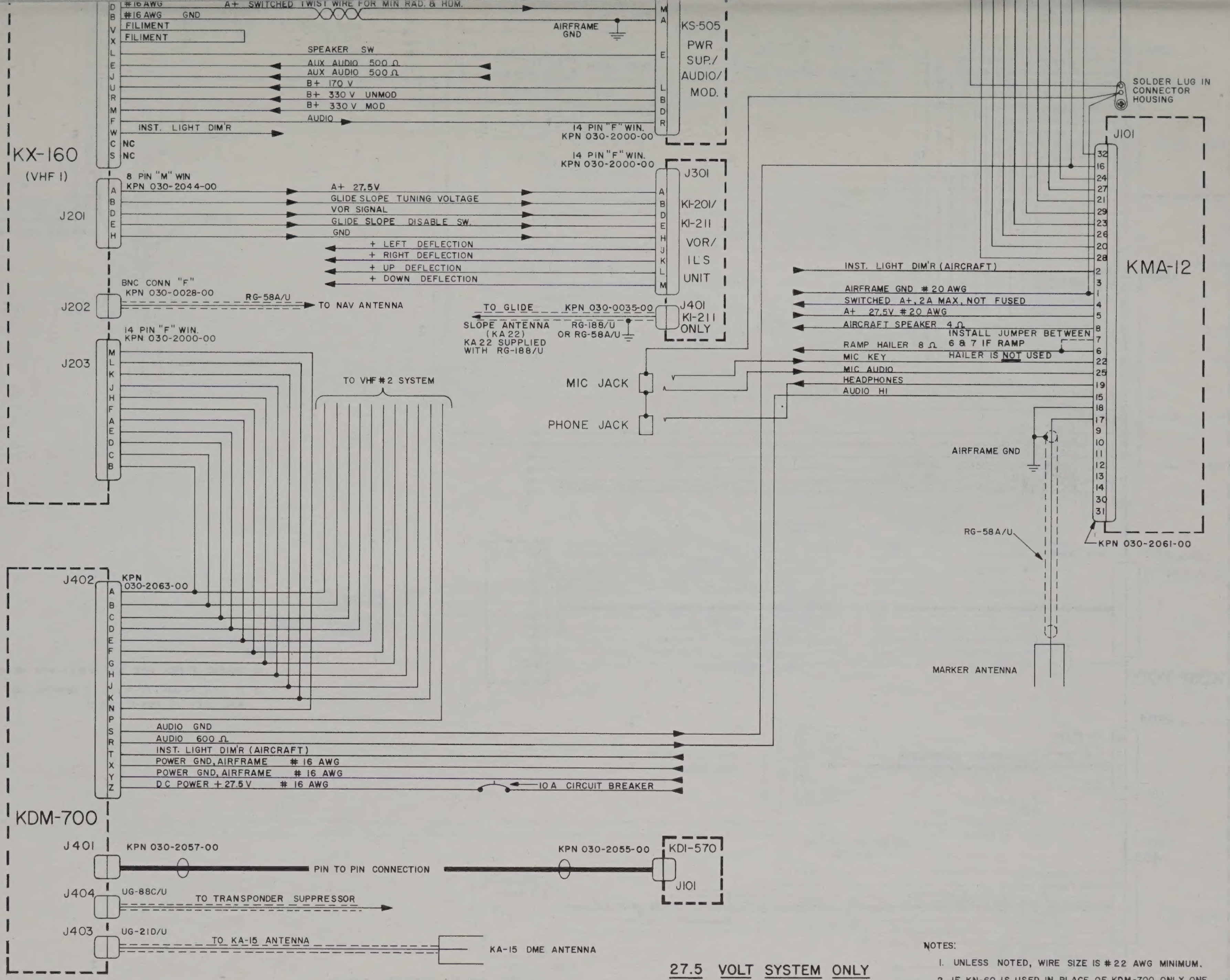
The 75 megacycle signal developed in the antenna is coupled through terminal 17 of J-101 to the antenna tuned transformer T-101. Capacitors C-101 and C-105 resonate the secondary of the tuned transformer and provide an impedance stepdown for correct matching into the emitter of the grounded base amplifier Q-101. A parallel resonant tank circuit consisting of L-101, C-107, and C-108, provide further 75 megacycle selectivity; and the two capacitors form an impedance stepdown network for proper impedance matching into the base connection of mixer Q-102.

The heterodyning source is supplied by oscillator Q-105. Oscillator Q-105 is a grounded base type oscillator having a tank circuit consisting of L-104, C-142, and C-143. This circuit is resonated to the oscillator frequency of 63.512 megacycles. The energy developed in the tank circuit is coupled to crystal Y-101 operating in a series mode to the emitter of Q-105. Sufficient energy is supplied by the crystal to the emitter of the transistor to maintain oscillation. Coupling from the oscillator to the mixer is accomplished by capacitor C-109 connected to the base of mixer transistor Q-102.

The difference frequency developed in mixer Q-102 is coupled from the transistor into the first IF transformer T-104, which is resonated with capacitor C-111. The IF signal is then transfered to the base of IF amplifier Q-104 through capacitor C-113 and the amplified signal is then applied by the collector circuit to the second IF transformer T-105 and resonating capacitor C-116. Capacitor C-118 couples the amplitude modulated IF signal to detector diode CR-102. R-121 provides a detector load resistor while the low pass network of L-105 and C-119 effectively remove the IF signal from the detected output. The direct current component of the detector output is applied through an AGC filter R-112, C-114, and R-110 to the base of AGC amplifier Q-103.

In the absence of a signal on the antenna, biasing


NOTES
1. UNLESS NOTED: ALL CAPACITANCES ARE IN MICROMICROFARADS, (pf).
ALL INDUCTANCES ARE IN MICROHENRIES,(uh).
ALL RESISTANCES ARE IN OHM & ARE 1/4 WATT, 10%
2. DIODE SYMBOLS ARE GERMANIUM SILICON ZENER
3. BOTTOM VIEW OF TRANSISTORS BASE COLLECTOR EMITTER
4. VOLTAGES IN DC WITH NO SIGNAL IN OR AUDIO IN.
5 (◇) DENOTES VALUE CHANGE.
AGC
Q103 GRN DOT
DET
I. F 11.488 mc
Q104
T105
T104
I.F. - MIX
Q102
3000 ∿ LITE FILTER
400 ∿ LITE FILTER
1300 ∿ LITE FILTER
Q108 YEL DOT
Q111 YEL DOT
Q114 YEL DOT
Q109
Q110
Q112
Q113
Q115
Q116
Q117
DS101 WHITE
DS102 BLUE
DS103 AMBER
V101
T103
(BLU/WHT)

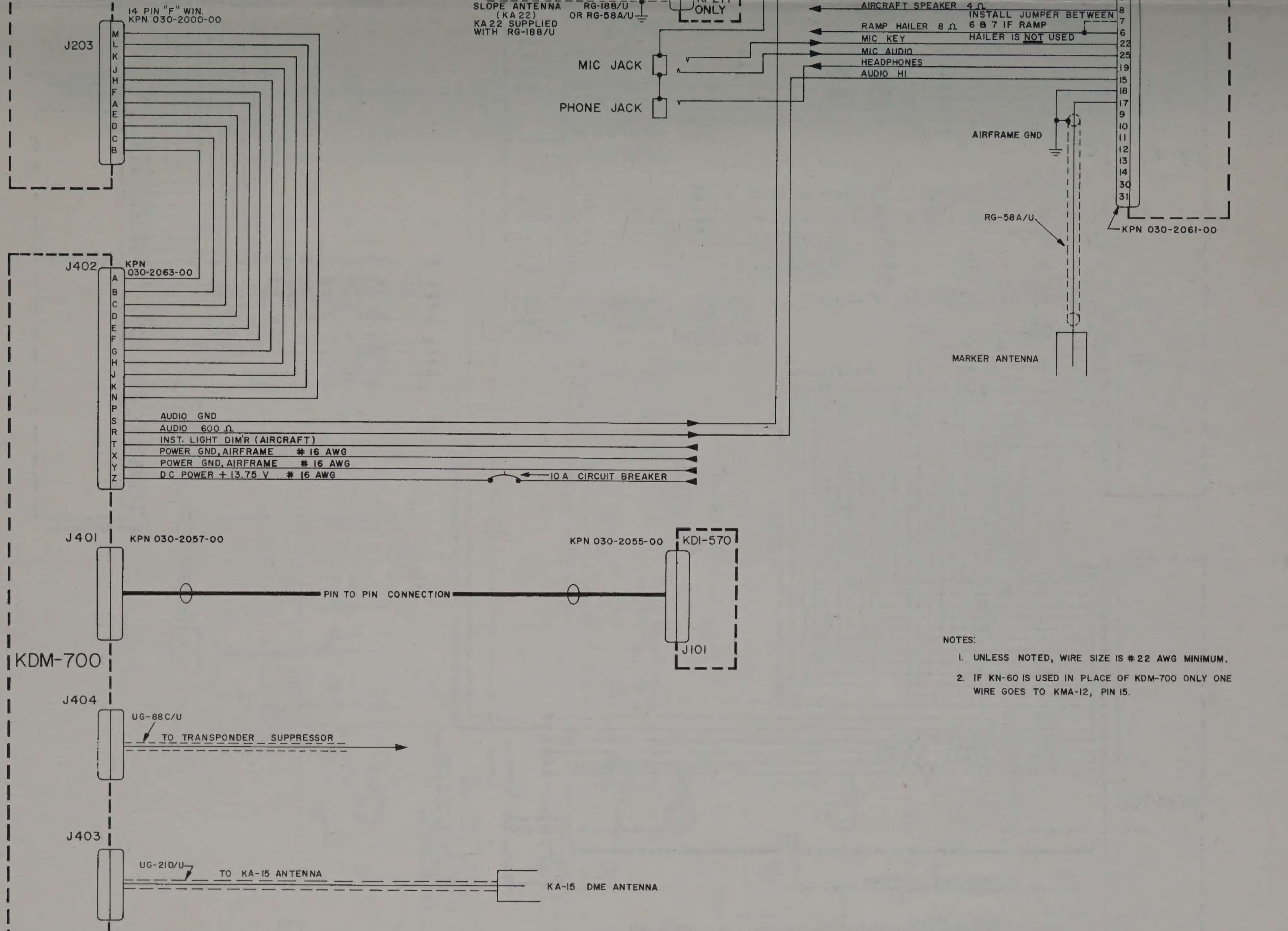


27.5 VOLT SYSTEM ONLY

NOTES:

1. UNLESS NOTED, WIRE SIZE IS # 22 AWG MINIMUM.
2. IF KN-60 IS USED IN PLACE OF KDM-700 ONLY ONE WIRE GOES TO KMA-12, PIN 15.

FIG.- 5 KMA-12 INSTALLATION WIRING DIAGRAM

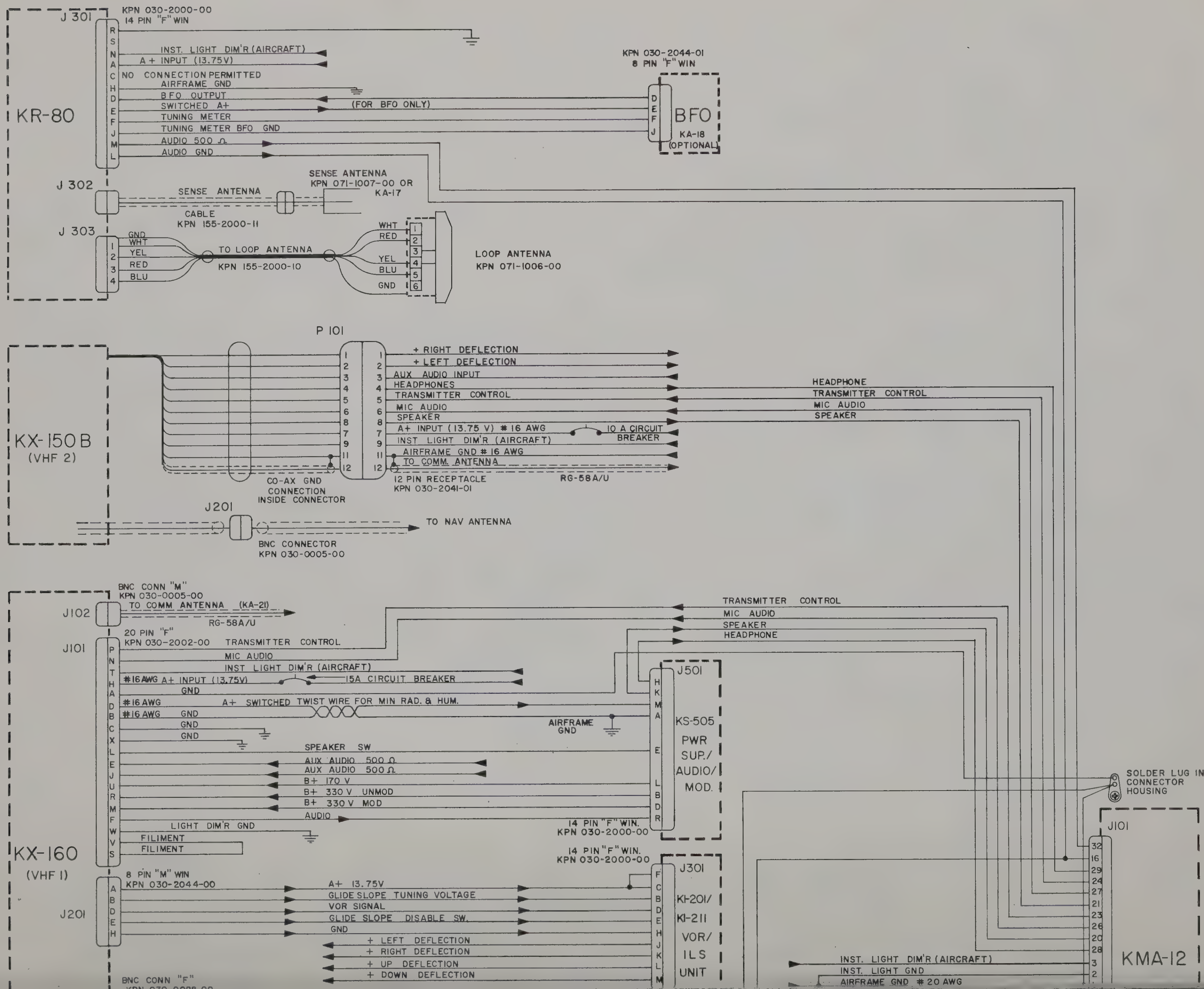


NOTES:

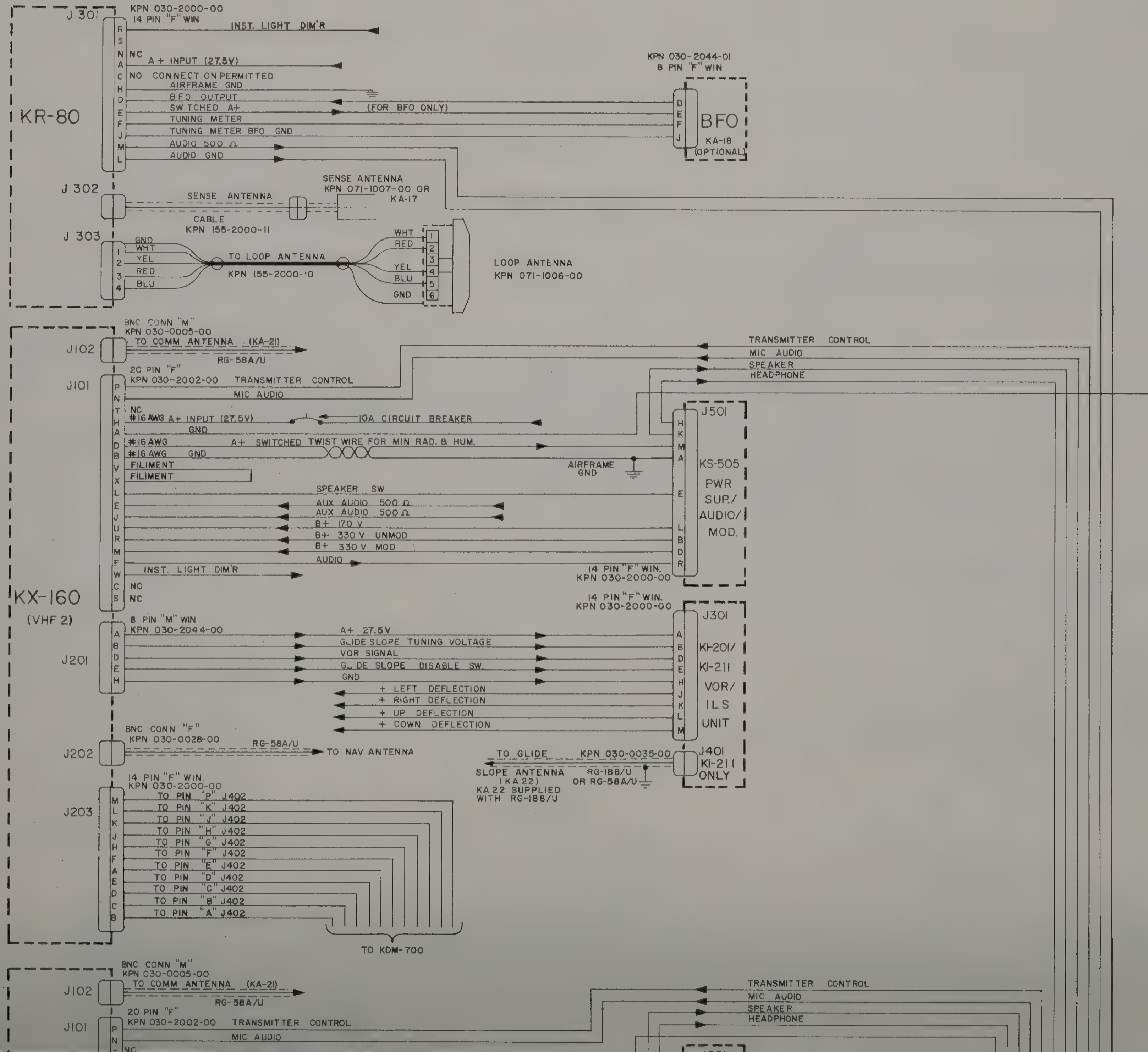
1. UNLESS NOTED, WIRE SIZE IS # 22 AWG MINIMUM.
2. IF KN-60 IS USED IN PLACE OF KDM-700 ONLY ONE WIRE GOES TO KMA-12, PIN 15.

13.75 VOLT SYSTEM ONLY

FIG.- 4 KMA-12 INSTALLATION WIRING DIAGRAM



J 301
KPN 030-2000-00
14 PIN "F" WIN
R S N A C H D E F J M L
INST. LIGHT DIM'R (AIRCRAFT)
A + INPUT (13.75V)
NO CONNECTION PERMITTED
AIRFRAME GND
B F O OUTPUT
SWITCHED A+
(FOR BFO ONLY)
TUNING METER
TUNING METER BFO GND
AUDIO 500 Ω
AUDIO GND
KR-80
KPN 030-2044-01
8 PIN "F" WIN
D E F J
BFO
KA-18
(OPTIONAL)
J 302
SENSE ANTENNA
SENSE ANTENNA
KPN 071-1007-00 OR
KA-17
CABLE
KPN 155-2000-11
J 303
GND
WHT
YEL
RED
BLU
TO LOOP ANTENNA
KPN 155-2000-10
WHT
RED
YEL
BLU
GND
LOOP ANTENNA
KPN 071-1006-00
P 101
+ RIGHT DEFLECTION
+ LEFT DEFLECTION
AUX AUDIO INPUT
HEADPHONES
TRANSMITTER CONTROL
MIC AUDIO
SPEAKER
A+ INPUT (13.75 V) # 16 AWG
10 A CIRCUIT BREAKER
INST LIGHT DIM'R (AIRCRAFT)
AIRFRAME GND # 16 AWG
TO COMM. ANTENNA
KX-150 B
(VHF 2)
CO-AX GND CONNECTION INSIDE CONNECTOR
12 PIN RECEPTACLE
KPN 030-2041-01
RG-58A/U
HEADPHONE
TRANSMITTER CONTROL
MIC AUDIO
SPEAKER
J201
TO NAV ANTENNA
BNC CONNECTOR
KPN 030-0005-00
BNC CONN "M"
KPN 030-0005-00
J102
TO COMM ANTENNA (KA-21)
RG-58A/U
J101
20 PIN "F"
KPN 030-2002-00
TRANSMITTER CONTROL
MIC AUDIO
INST LIGHT DIM'R (AIRCRAFT)
#16AWG A+ INPUT (13.75V)
15A CIRCUIT BREAKER
GND
#16 AWG
A+ SWITCHED TWIST WIRE FOR MIN RAD. & HUM.
#16 AWG GND
GND
GND
AIRFRAME GND
SPEAKER SW
AUX AUDIO 500 Ω
AUX AUDIO 500 Ω
B+ 170 V
B+ 330 V UNMOD
B+ 330 V MOD
AUDIO
LIGHT DIM'R GND
FILIMENT
FILIMENT
P N T H A D B C X L E J U R M F W V S
TRANSMITTER CONTROL
MIC AUDIO
SPEAKER
HEADPHONE
J501
H K M A E L B D R
KS-505
PWR SUP./ AUDIO/ MOD.
14 PIN "F" WIN.
KPN 030-2000-00
SOLDER LUG IN CONNECTOR HOUSING
KX-160
(VHF 1)
J201
8 PIN "M" WIN
KPN 030-2044-00
A B D E H
A+ 13.75V
GLIDE SLOPE TUNING VOLTAGE
VOR SIGNAL
GLIDE SLOPE DISABLE SW.
GND
+ LEFT DEFLECTION
+ RIGHT DEFLECTION
+ UP DEFLECTION
+ DOWN DEFLECTION
14 PIN "F" WIN.
KPN 030-2000-00
J301
F C B D E H J K L M
KI-201/ KI-211 VOR/ ILS UNIT
J101
32 16 29 24 27 21 23 26 20 28 3 2
KMA-12
INST. LIGHT DIM'R (AIRCRAFT)
INST. LIGHT GND
AIRFRAME GND # 20 AWG
BNC CONN "F"



KR-80
J 301
KPN 030-2000-00
14 PIN "F" WIN
INST. LIGHT DIM'R
NC
A + INPUT (27.5V)
NO CONNECTION PERMITTED
AIRFRAME GND
BFO OUTPUT
SWITCHED A+
(FOR BFO ONLY)
TUNING METER
TUNING METER BFO GND
AUDIO 500 Ω
AUDIO GND
KPN 030-2044-01
8 PIN "F" WIN
BFO
KA-18
(OPTIONAL)
J 302
SENSE ANTENNA
CABLE
KPN 155-2000-11
SENSE ANTENNA
KPN 071-1007-00 OR
KA-17
J 303
GND
WHT
YEL
RED
BLU
TO LOOP ANTENNA
KPN 155-2000-10
LOOP ANTENNA
KPN 071-1006-00
KX-160
(VHF 2)
J102
BNC CONN "M"
KPN 030-0005-00
TO COMM ANTENNA (KA-21)
RG-58A/U
J101
20 PIN "F"
KPN 030-2002-00
TRANSMITTER CONTROL
MIC AUDIO
SPEAKER
HEADPHONE
#16 AWG A+ INPUT (27.5V)
10A CIRCUIT BREAKER
#16 AWG
A+ SWITCHED TWIST WIRE FOR MIN RAD. & HUM.
#16 AWG GND
FILIMENT
FILIMENT
AIRFRAME GND
SPEAKER SW
AUX AUDIO 500 Ω
AUX AUDIO 500 Ω
B+ 170 V
B+ 330 V UNMOD
B+ 330 V MOD
AUDIO
INST. LIGHT DIM'R
J501
KS-505
PWR
SUP./
AUDIO/
MOD.
14 PIN "F" WIN.
KPN 030-2000-00
J201
8 PIN "M" WIN
KPN 030-2044-00
A+ 27.5V
GLIDE SLOPE TUNING VOLTAGE
VOR SIGNAL
GLIDE SLOPE DISABLE SW.
GND
+ LEFT DEFLECTION
+ RIGHT DEFLECTION
+ UP DEFLECTION
+ DOWN DEFLECTION
J301
KI-201/
KI-211
VOR/
ILS
UNIT
J202
BNC CONN "F"
KPN 030-0028-00
RG-58A/U
TO NAV ANTENNA
TO GLIDE SLOPE ANTENNA (KA 22)
KA 22 SUPPLIED WITH RG-188/U
KPN 030-0035-00
RG-188/U OR RG-58A/U
J401
KI-211
ONLY
J203
14 PIN "F" WIN.
KPN 030-2000-00
TO PIN "P" J402
TO PIN "K" J402
TO PIN "J" J402
TO PIN "H" J402
TO PIN "G" J402
TO PIN "F" J402
TO PIN "E" J402
TO PIN "D" J402
TO PIN "C" J402
TO PIN "B" J402
TO PIN "A" J402
TO KDM-700
J102
BNC CONN "M"
KPN 030-0005-00
TO COMM ANTENNA (KA-21)
RG-58A/U
J101
20 PIN "F"
KPN 030-2002-00
TRANSMITTER CONTROL
MIC AUDIO
SPEAKER
HEADPHONE

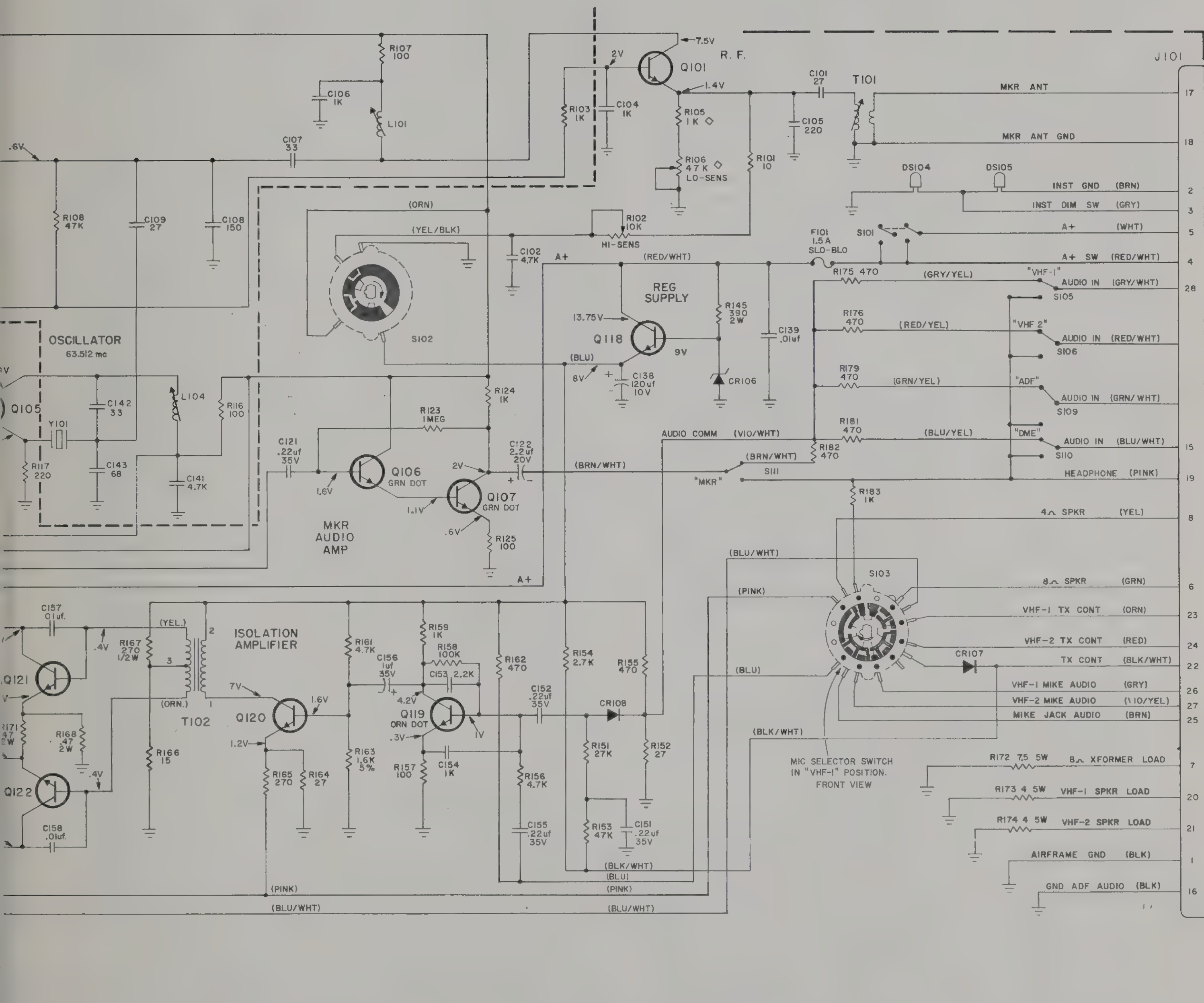


FIG-3 KMA-12 MARKER-BEACON AMPLIFIER SCHEMATIC REV. 3 4/12/65

current for the RF amplifier Q-101 and Q-102 is supplied by bias resistor R-104. However, as a 75 megacycle signal is applied to the antenna a positive voltage is developed by detector CR-102 and applied through the AGC filter to Q-103. The effect is to turn on the AGC amplifier Q-103, reducing the bias voltage at the collector of Q-103 toward ground potential. Under heavy signal conditions, Q-103 approaches saturation and the RF amplifier Q-101 and mixer Q-102 are operated in nearly cutoff condition.

The audio frequency signal developed by the detector diode is coupled to the selective filters Q-108, Q-111, and Q-114 by capacitor C-123, C-127, and C-133. These amplifiers achieve selectivity by the selective feedback method. An examination of the circuitry of Q-108, the 3000 cps selective amplifier, will show that C-125, C-124, R-126, and R-127 provide what is commonly called a shunt-T network. The values of the resistors and capacitors are selected to provide a sharp null or notch in their transfer characteristic at 3000 cps. Thus, at 3000 cps, amplifier Q-108 behaves as a high gain single stage amplifier, whereas, at other frequencies, feedback from the collector to the base by the shunt-T network reduces the gain. The 400 cps and 1300 cps amplifiers operate in a similar fashion except for component value differences.

The energy is capacity coupled through capacitor C-126 to the base of detector-current amplifier Q-109 and diode CR-103. The 3000 cps signal is rectified and develops the DC base to emitter bias for transistor Q-109. The rectified current is filtered by C-130. The DC voltage developed across C-130 applies a biasing current through resistor R-129 to the base of light switch Q-110. This base current is sufficient to saturate the transistor, and thus draw sufficient current to light the white light in the panel of the KMA-12 to a brilliancy determined by the ambient light sensing circuit consisting of V-101, Q-117, R-143, and R-144.

The light sensitive resistor V-101 is located in the front panel of the KMA-12 and receives light energy proportional to that existing in the cockpit at any particular time. The resistance value of V-101 will vary from several meg ohms under complete darkness to only a few hundred ohms with incident sunlight such as would exist in an aircraft cockpit in clear sunlight conditions. This variable resistance is connected as a base biasing resistor for Q-117 so that under high ambient lighting Q-117 is turned on to nearly saturated condition and under high lighting conditions the voltage drop across Q-117 is less than 1 volt. In complete darkness the variable resistor V-101 is so high that Q-117 is in cutoff and under these conditions the minimum brilliancy level of the panel lights is determined by R-143.

The audio amplifier for the marker beacon receiver consists of Q-106 and Q-107. The audio signal developed in the detector is connected through capacitor C-121 to emitter follower Q-106 and then to the base of Q-107. The emitter follower connection provides a high input impedance to avoid loading the diode detector CR-102. The amplified audio signal appearing at the collector of Q-107 is coupled by capacitor C-122 to the marker receiver audio control switch S-111 which in turn connects the audio signal either to the headphone line or to the input of the isolation amplifier through resistor R-182.

Sensitivity of the marker receiver is determined by the emitter resistors R-105 and R-106 in low sensitivity condition. In high sensitivity position resistors R-101 and R-102 are paralleled with R-105 and R-106 through a connection made in switch S-102.

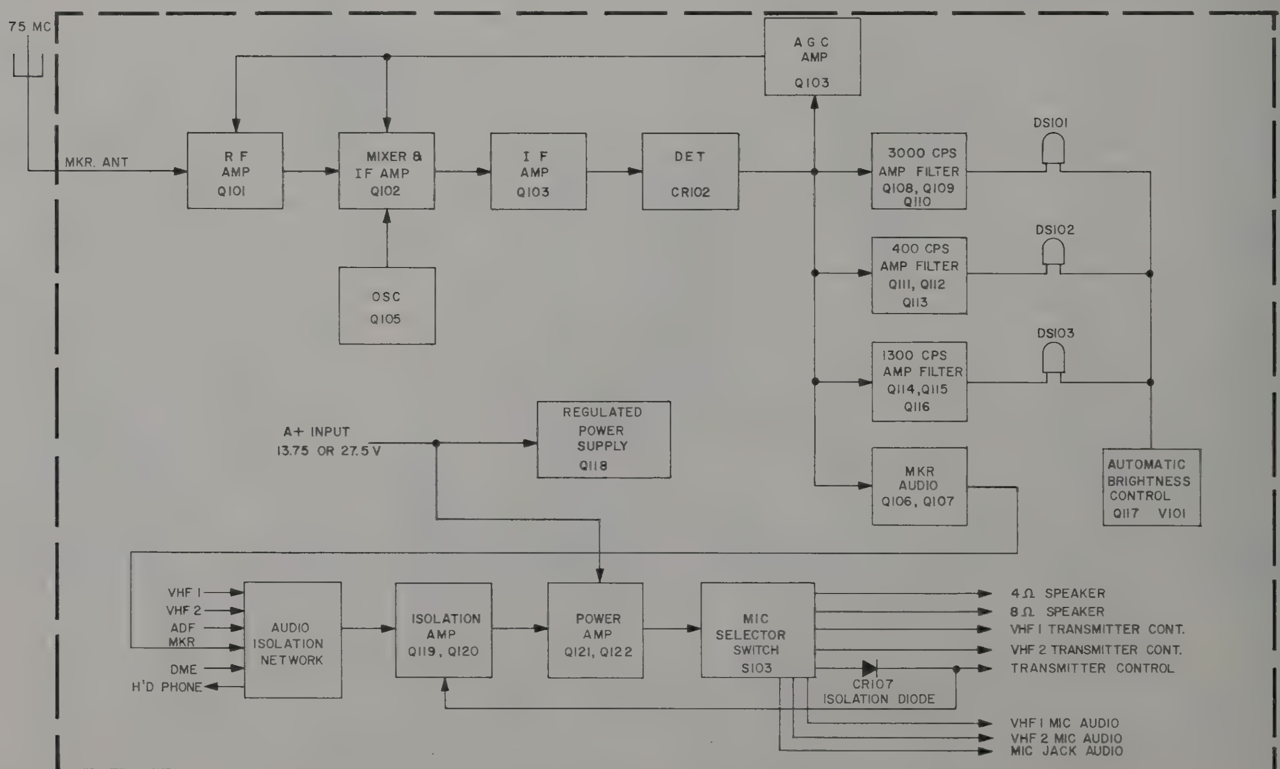


FIG.- 6 KMA-12 BLOCK DIAGRAM

ISOLATION AMPLIFIER

The KMA-12 isolation speaker amplifier is a three stage circuit with a grounded emitter class B output circuit. The audio signal from the various receivers in the aircraft are coupled through the toggle-type audio selector switches, isolation resistors CR-108 and C-152. CR-108 is a transmit muting diode and will be covered in the next section. The audio signals appearing at the base of Q-119 are amplified and coupled from the collector to the base of driver transistor Q-120 by capacitor C-156. Driver amplifier Q-120 is operated as a grounded emitter amplifier and the amplified signal appearing at the collector is coupled via transformer T-102 to the base of the class B push-pull stage comprising transistors Q-121 and Q-122. Bias supply for the final amplifier transistors is supplied to the center tap of T-102 secondary. The resistor network in the emitters of the amplifier provide balance and temperature compensation. Capacitors C-157 and C-158 provide high frequency roll-off for the amplifier. The push-pull output of Q-121 and Q-122 is applied to the primary of output transformer T-103. The secondary of T-103 has a tap at the 4Ω (terminal #5) and 8Ω connections (terminal #6).

The last two stages of the amplifier are operating with inverse feedback to reduce distortion and to provide a flat frequency response. This feedback is applied from terminal #5 of transformer T-103 to the emitter of Q-120 through resistor R-165. The choice of coupling capacitors C-152, C-156, and high frequency roll-off capacitors C-153, C-157, and C-158, are selected to provide a nearly flat frequency response from 300 cps to 6000 cps. The voltage supply regulator mostly comprised of Q-118 and CR-106 supplies closely regulated and highly filtered voltage to all of the marker beacon receiver circuits and to the first two amplifier stages of the isolation speaker amplifier. CR-106 is a zener type voltage regulator diode. This diode is operated in the reverse condition and shows a sharp increase in current at a selected voltage level. Thus, the voltage of the base of Q-118 is held nearly fixed even though the supply current through R-145 should vary considerably. The zener diode and R-145 are chosen such that, after the supply voltage applied to the power connection (pin 4) rises above 11 volts, the supply voltage may be raised to 30 volts without a significant increase in the voltage at the base of Q-118. Due to the current gain of Q-118, the supply voltage to the collector may also vary considerably without a material change in the emitter voltage from which the regulated supply energy is taken. In order to provide an extremely low output impedance at higher frequencies, a tantalum capacitor, C-138, is paralleled between the emitter and ground. It is because of the regulator that the isolation speaker amplifier and marker beacon receiver are not susceptible to line voltage variations and noise created by the aircraft alternator and other disturbances. Unregulated line voltage is supplied to the collector circuit of the class B amplifier; however, due to the fact that no further amplification takes place after this stage and because of the noise cancelling affect of the inverse feedback loop (terminal #5 of T-103 to emitter or Q-102), line transients still do not appear in the speaker output. While the isolation speaker amplifier will provide 10 to 12 watts output with a 28 volt supply, the undistorted output with a 14 volt supply is limited to 6 watts because of the lower voltage supplied to the class B amplifier.

AUDIO SECTION

The five miniature toggle switches in the center of the KMA-12 front panel have three positions. The center position provides an open circuit. The "down" position of each switch connects the audio input directly to the headphone jack of the aircraft instrument panel. When the switch is in the "up" position, the headphone output of the receivers is connected through the isolation resistors R-175, R-176, R-179 R-181, and R-182, to the junction of CR-108 and isolating network resistor R-152.

CR-108 is the audio muting switch which disconnects all receiver inputs from the isolation speaker amplifier during transmit or ramp hailing operation. Please note that resistor R-153 is connected to the transmit control connector, (terminal #22), which is connected directly to the control contact of the pilot's microphone. When the microphone button is not depressed, the transmit control line is ungrounded and diode CR-108 is turned on by current flowing from the regulated supply line through resistors R-154, R-153, R-151, the diode, and R-152 to ground. Under this condition the diode, CR-108, is conducting and audio signals appearing at its junction with R-152 will be conducted through the diode through capacitor C-152 to the base of the first amplifier. When the microphone button is depressed, the junction of R-154 and R-153 is grounded and the anode side of CR-108 is reduced to ground potential as the voltage developed across C-151 decays to zero. C-151 provides a transient filter to keep the sudden change in voltage from being transferred at an audio rate to the input of the isolation amplifier. To further insure that CR-108 will be cut off during transmit condition, a slightly positive voltage is applied to the cathode by the connection of R-155 to the regulated supply line. The operation of the microphone selector switch, S-103, is rather selfexplanatory. With the switch in VHF 1 position the microphone audio circuit is connected between terminals #25 and #26 of the connector plug and between #25 and #27 in VHF 2 position. The transmit control line, terminal #22, is connected to terminal #23 in VHF 1 position and terminal #24 in VHF 2 position. The 4Ω output terminal of the isolation amplifier is connected to the cabin speaker, terminal #8, in VHF 1 and VHF 2 position; while the 8Ω tap is connected to the ramp hailer speaker line, terminal #6, in AMP position. Resistor R-183 connects a small amount of the isolation speaker amplifier energy to the headphone line in the AMP position so that the unit may be used as a pilot to co-pilot intercom. In the AMP position it is necessary to connect the microphone to the input of the isolation speaker amplifier. In this case, microphone current is supplied by R-162, and capacitor C-155 couples the microphone output to the base of transistor Q-119 through resistor R-156. Diode CR-107 eliminates a "sneak path" which can occur when the microphone selector switch is turned to one of the VHF sets and the and the set is not turned on.

MAINTENANCE

No attempt has been made at this writing to describe specific component failure. Refer to the schematic for DC voltage measurements and stage gain measurements. The circuit theory describes any unique features of the KMA-12.

TEST EQUIPMENT

RF Signal Generator:
 Hewlett-Packard Model 608D or a signal generator that produces a 75.00 Mc calibrated output, capable of being modulated externally (without frequency modulation) 95% by 400 cps, 1300 cps, and 3000 cps.
Audio Signal Generator:
 Hewlett-Packard Model 200CD or equivalent.
Power Supply:
 Universal Electronics Model L3501 or equivalent.
AC VTVM:
 Eico 260 or equivalent.
VTVM:
 Heath Model IM-13 or equivalent.
Volts Ohm Millimeter:
 Precision Model 120M or equivalent (20,000 ohm/volt DC).
KMA-12 Bench Test Kit:
 Part No. 050-1063-00.
Tuning Tool:
 To adjust slugs in coils.

ALIGNMENT AND CALIBRATION

IF ALIGNMENT:

a. Connect the AC VTVM between ground and the junction of L-105 and C-119.
b. Connect the RF generator to the base of Q-102 through a .01uf capacitor.
c. Set generator at 11.488 Mc and modulate 95% with 1300 cps. Start with all slugs, in the receiver, at minimum inductance.
d. Tune T-104 and T-105 for a peak voltage on voltmeter. (Keep voltage below .2 volts). When T-104 and T-105 are peaked, an input of 100 microvolts will give .15 volts.

OSCILLATOR ALIGNMENT:

a. Connect the DC VTVM to the base of Q-105 and tune L-104 for minimum DC voltage (+1.2 volts DC).

RF ALIGNMENT:

a. Connect the AC VTVM between ground and the junction of L-105 and C-119.
b. Connect the RF generator to pins 17 and 18 of J-101. (Pin 17 is the antenna and pin 18 is antenna ground).
c. Set generator at 75 Mc and modulate 95% with 1300 cps.
d. Tune T-101 and L-101 for maximum voltage on voltmeter. (Keep voltage below .2 volts).
e. Set receiver in "LO" position and set generator at 1500 microvolts.
f. Connect the DC VOM across DS-103.
g. Adjust R-106 for a voltage reading of 2.3 volts DC across lamp. Check to see that the amber lamp is at threshold. Caution: MAKE SURE light censor (V-101) is not covered.
h. Set receiver in "HI" position and generator at 250 microvolts.
j. Adjust R-102 for 2.3 volts across DS-103. A visual check for threshold of all three lamps should be made. Caution should again be taken not to cover light censor.

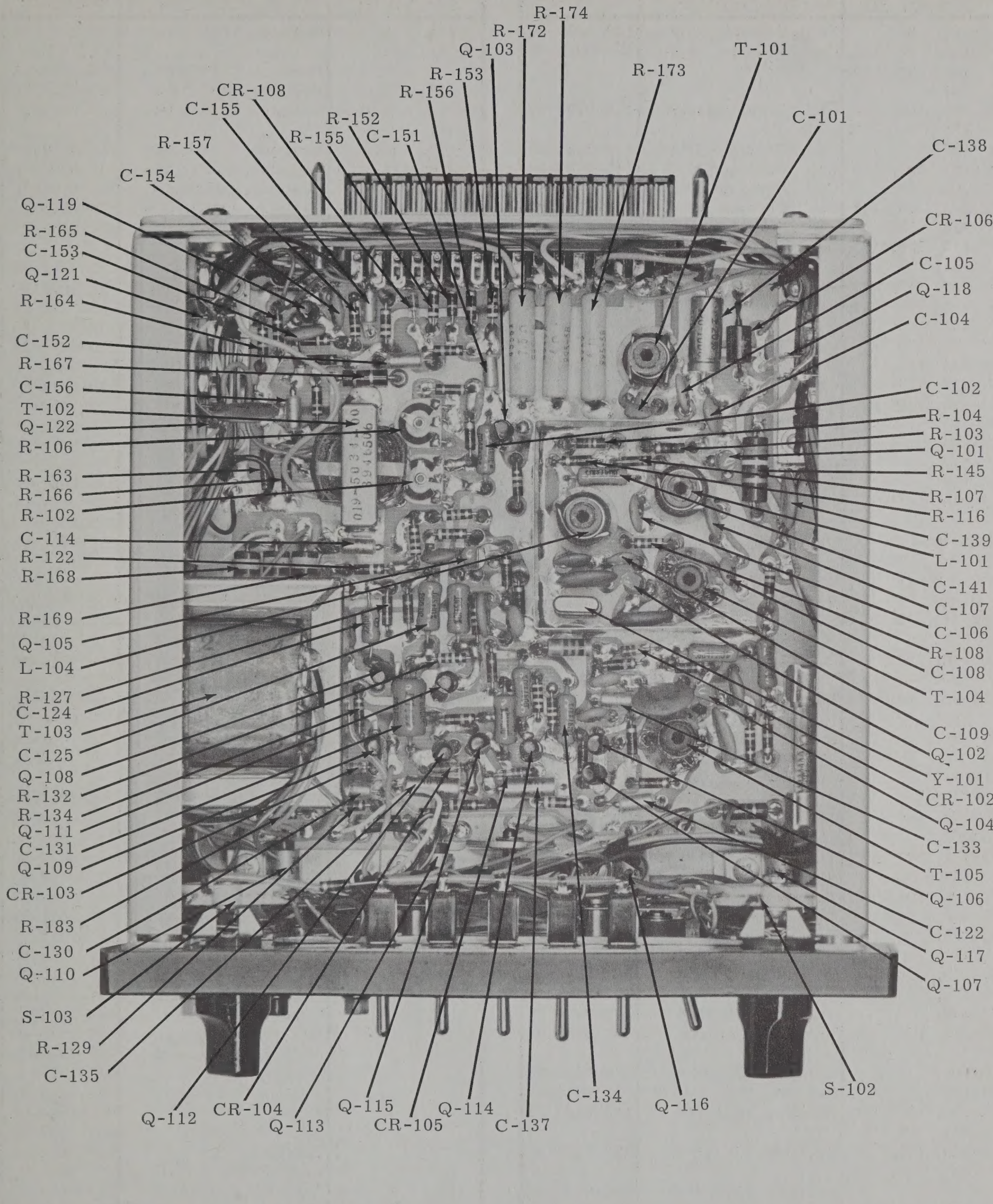


FIG. - 7 KMA-12 TOP VIEW

KMA-12 PARTS LIST

SYMBOL NO.	DESCRIPTION	PART NO.
C-101, 109	Cap., Ceramic, 27pf	113-3270-00
C-102, 112, 115, 126, 134, 135, 141	Cap., Mylar, 4.7Kpf	105-0018-38
C-104, 106, 113, 154	Cap., Ceramic, 1Kpf	113-5102-00
C-105	Cap., Ceramic, 220pf	113-3221-00
C-107, 142, 144	Cap., Ceramic, 33pf	113-3330-00
C-108, 123	Cap., Ceramic, 150pf	113-3151-00
C-111, 116, 143	Cap., Ceramic, 68pf	115-3680-01
C-114, 156	Cap., Tantalum, 1.0uf	096-1005-00
C-117, 139, 157, 158	Cap., Ceramic, .01uf	115-7103-00
C-118, 119, 133	Cap., Ceramic, 300pf	113-5301-00
C-121, 151, 152, 155	Cap., Tantalum, .22uf	096-1013-00
C-122, 130	Cap., Tantalum, 2.2uf	096-1007-00
C-124, 125	Cap., Mylar, 2.2Kpf	105-0018-26
C-127, 153	Cap., Ceramic, 2.2Kpf	114-7222-00
C-128, 129, 136	Cap., Mylar, .015uf	105-0018-56
C-131	Cap., Mylar, .047uf	105-0018-74
C-132	Cap., Tantalum, 10uf	096-1015-00
C-137	Cap., Tantalum, 4.7uf	096-1004-00
C-138	Cap., Tantalum, 120uf	096-1019-00
C-160, 161	Cap., Ceramic, 120uf	113-3121-00
CR-102, 103, 104, 105	Diode, Germanium	007-6009-00
CR-106	Diode, Zener	007-5002-00
CR-107	Rectifier, Silicon	007-6021-00
CR-108	Diode, Silicon	007-6008-00
DS-101, 102, 103	Bulb, 6.3V	037-0009-00
DS-104, 105	Bulb, 14V	037-0007-03
F-101	Fuse, 1 1/2 Amp	036-0005-00
J-101	Connector, 32 Pin	030-2060-00
L-101, 104	Coil, 75 Mc	019-3014-00
L-105	Choke, Molded, 22uh	019-2067-00
Q-101, 102, 104, 105	Transistor, Silicon	007-0036-00
Q-103, 106, 107	Transistor, Silicon	007-0033-00
Q-108, 111, 114	Transistor, Silicon	007-0032-00
Q-109, 112, 115, 119	Transistor, Silicon	007-0031-00
Q-110, 113, 116, 117,	Transistor, Silicon	007-0026-00
Q-120	Transistor, Silicon	007-0038-00
Q-118, 121, 122	Transistor, Silicon	007-0030-00
R-101	Resistor, 10Ω, 1/4w	130-0100-25
R-102	Resistor, Var., 10KΩ	133-0016-03
R-103, 105, 118, 124, 159, 183	Resistor, 1KΩ, 1/4w	130-0102-25
R-104, 121, 134, 141, 144, 146	Resistor, 10KΩ, 1/4w	130-0103-25
R-106	Resistor, Var., 47K	133-0016-00
R-107, 116, 125, 157	Resistor, 100Ω, 1/4w	130-0101-25
R-108, 110, 112, 153	Resistor, 47KΩ, 1/4w	130-0473-25
R-109, 129, 135, 142, 155, 162	Resistor, 470Ω, 1/4w	130-0471-25

SYMBOL NO.	DESCRIPTION	PART NO.
175, 176, 179, 181, 182	Resistor, 470Ω, 1/4w	130-0471-25
R-111, 131, 136	Resistor, 270KΩ, 1/4w	130-0274-25
R-113, 117	Resistor, 220Ω, 1/4w	130-0221-25
R-114, 119, 156, 161	Resistor, 4.7KΩ, 1/4w	130-0472-25
R-115, 154	Resistor, 2.7KΩ, 1/4w	130-0272-25
R-122, 128, 158	Resistor, 100KΩ, 1/4w	130-0104-25
R-123	Resistor, 1MegΩ, 1/4w	130-0105-25
R-126, 132, 137	Resistor, 470KΩ, 1/4w	130-0474-25
R-127, 133, 138, 163	Resistor, 1.6KΩ, 1/4w	130-0162-23
R-143	Resistor, 100Ω, 1/2w	130-0101-35
R-145	Resistor, W/W, 390Ω, 2w	132-5008-00
R-151	Resistor, 27KΩ, 1/4w	130-0273-25
R-152, 164	Resistor, 27Ω, 1/4w	130-0270-25
R-165	Resistor, 270Ω, 1/4w	130-0271-25
R-166	Resistor, 15Ω, 1/4w	130-0150-25
R-167	Resistor, 270Ω, 1/2w	130-0271-35
R-168, 169, 171	Resistor, W/W, 0.47Ω, 2w	132-5009-00
R-172	Resistor, W/W, 7.5Ω, 5w	132-0024-00
R-173, 174	Resistor, W/W, 4Ω, 5w	132-0023-00
S-101	Switch, Off/On	031-0054-00
S-102	Switch, Marker	031-0051-00
S-103	Switch, Mic	031-0052-00
S-105, 106, 109, 110, 111	Switch, Toggle	031-0050-00
T-101	Transformer, 75 Mc	019-3013-00
T-102	Transformer, Audio	019-5034-00
T-103	Transformer, Audio	019-5033-00
T-104, 105	Coil, IF, 11.488	019-8016-00
V-101	Photo Cell	134-5001-00
Y-101	63.51 Mc	045-1003-00
	Circuit Board, KMA-12	009-5021-00
	Fuseholder	033-0004-00
	Socket, Transistor	033-0026-00
	Socket, Indicator Light	037-0010-00
	Lens, Indicator White	037-0011-00
	Lens, Indicator Blue	037-0011-01
	Lens, Indicator Amber	037-0011-03
	Decal, FCC Tag	047-1057-00
	Contact Spring	047-1102-00
	Contact Spring	047-1173-00
	Side Plate, Left Side	047-1214-02
	Connector, 32 Pin	030-2061-00
	Side Plate, Right Side	047-1215-02
	Mtg. Plate Connector	047-1222-01
	Cover, Connector	047-1223-00
	Equipment Cover	047-1224-00
	Shield, R F	047-1229-00
	Name Plate, KMA-12	057-1054-00
	Plastic Spacer	076-0011-01
	Lead Screw	076-0065-00
	Face Plate, KMA-12	088-0064-10
	V-101 & Y-101 Spacer	088-0066-00
	Locking Lever	088-0068-00
	Knob	088-0069-00
	Retainer, Socket	090-0064-00
	Transistor Insulator	091-0025-00
	Mica Insulator	091-0035-00